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Pinecliff Lake, Passaic County, New Jersey

National Environmental Research Center

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May 1976

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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NATIONAL EUTROPHICATION SURVEY

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REPORT
ON
PINECLIFF LAKE
PASSAIC COUNTY
NEW JERSEY
EPA REGION II
WORKING PAPER No. 372

WITH THE COOPERATION OF THE
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
AND THE
NEW JERSEY NATIONAL GUARD
MAY 1976

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the New Jersey Department of Environmental Protection for professional involvement and to the New Jersey National Guard for conducting the tributary sampling phase of the Survey.

Douglas Clark, Chief of the Bureau of Water Quality Planning and Management, Mr. Frank Takacs, New Jersey National Eutrophication Survey Coordinator, Principal Environmental Specialist, and Robert Kotch, Senior Environmental Engineer, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

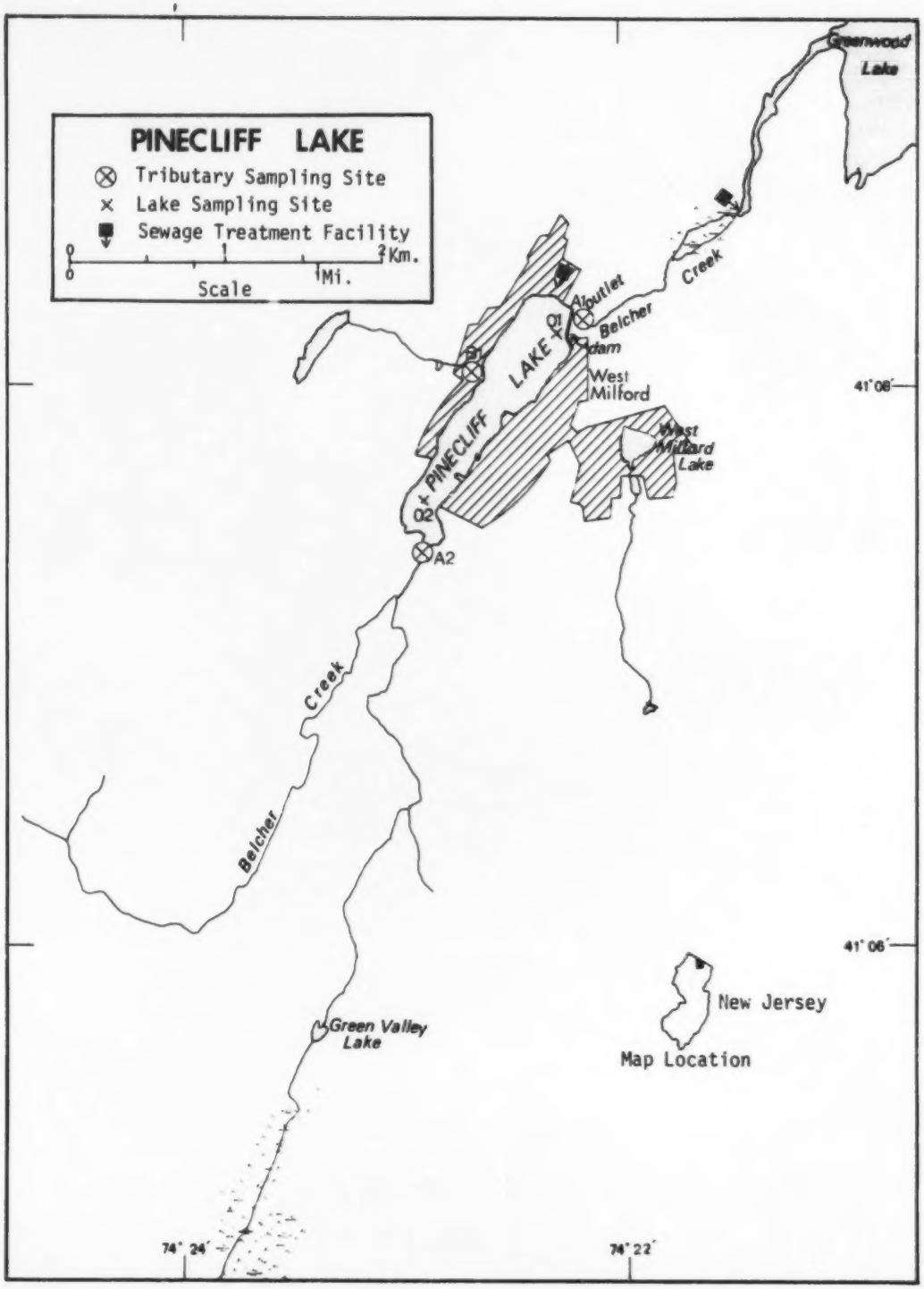
Major General William R. Sharp, Former Chief of Staff, Major General Wilfred G. Menard, Jr., Chief of Staff, and Project Officer Colonel Herbert D. Ruhlin, who directed the volunteer efforts of the New Jersey National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW JERSEY

LAKE NAME	COUNTY
Budd Lake	Morris
Duhernal Lake	Middlesex
Farrington Lake	Middlesex
Greenwood Lake	Passaic, N.J.; Orange, N.Y.
Lake Hopatcong	Morris, Sussex
Lake Musconetcong	Morris, Sussex
Oradell Reservoir	Bergen
Paulinskill Lake	Sussex
Pinecliff Lake	Passaic
Pompton Lakes	Passaic
Spruce Run Reservoir	Hunterdon
Union Lake	Cumberland
Wanaque Reservoir	Passaic


PINECLIFF LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0 1 2 Km.
0 1 Mi.
Scale
Greenwood Lake
Outlet
Belcher Creek
Dam
Q1
LAKE
West Milford
West Milford Lake
PINECLIFF
Q2
A2
Belcher Creek
Green Valley Lake
41°08'
41°06'
74°24'
74°22'
New Jersey
Map Location

PINECLIFF LAKE, NEW JERSEY

STORET NO. 3409

I. CONCLUSIONS

A. Trophic Condition:

Pinecliff Lake is considered eutrophic based upon field observations and Survey data. Survey limnologists reported seeing algae blooms and some emergent aquatic weeds in shallow areas. The water was a turbid green with a mean Secchi disc reading of 87.6 cm.

Chlorophyll a levels ranged from a low in the spring of 9.1 µg/l to a high in the fall of 121.4 µg/l. Nutrient concentrations and the potential for primary production as measured by algal assay control yield were high.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Pinecliff Lake was limited by available nitrogen. Spikes with nitrogen or nitrogen and phosphorus simultaneously resulted in increased assay yields. The addition of phosphorus alone did not stimulate a growth response. The mean total inorganic nitrogen to mean orthophosphorus ratio (N/P) further substantiates these results.

C. Nutrient Controllability:

1. Point Sources -

The mean annual phosphorus load from point sources was estimated to be 53.8% of the total reaching Pinecliff Lake. The Crescent Park wastewater treatment plant contributed 31.3% of the load. The nutrient loading rate to Pinecliff Lake of 3.47 $g/m^2/yr$ was 8.1 times the "permissible" loading proposed by Vollenweider (Vollenweider and Dillon, 1974) and 4.0 times the "dangerous" load. It should be noted, however, that Vollenweider's model may not be applicable to lakes with such short hydraulic retention times. Elimination of known point source phosphorus input may slow the present eutrophication rate and should create a phosphorus limiting condition within the lake, more amenable to further control.

2. Non-point Sources -

Non-point sources contributed 45.2% of the phosphorus loading reaching Pinecliff Lake. Measured tributaries accounted for 43.4% of the total phosphorus load and the ungaged drainage areas were estimated to contribute 1.8% of the load.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. The lake surface area and mean depth were provided by the State of New Jersey. Tributary flow data were provided by the New Jersey District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by the mean flow of the outlet. Precipitation values were estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 0.57 km^2.
2. Mean depth: 1.8 meters.
3. Maximum depth: 6.1 meters.
4. Volume: 1.026×10^6 m^3.
5. Mean hydraulic retention time: 32 days.

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

Name	Drainage area(km^2)	Mean flow (m^3/sec)
A(2) Belcher Creek	14.1	0.27
B(1) Unnamed Creek	1.6	0.05
Minor tributaries and immediate drainage -	2.6	0.05
Totals	18.3	0.37

2. Outlet -

A(1) Belcher Creek	18.8	0.37

C. Precipitation:

1. Year of sampling: 122.9 centimeters.

2. Mean annual: 156.4 centimeters.

III. LAKE WATER QUALITY SUMMARY

Pinecliff Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake (Station 2 was sampled only twice) and from one or more depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first visit, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 2.1 meters at Station 1 and 0 meters at Station 2. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III B. Results of the limiting nutrient study are presented in III C.

PINECLIFF LAKE
STORET CODE 3409

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(4/16/73) S*** = 2 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(7/23/73) S*** = 1 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/ 2/73) S*** = 2 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	3	13.0- 13.2	13.1	0.0- 1.5	1	25.7- 25.7	25.7	0.0- 0.0	3	18.4- 18.9	18.9	0.0- 1.5
MAX DEPTH**	2	13.0- 13.2	13.1	0.0- 1.5	1	24.4- 24.4	24.4	2.1- 2.1	2	18.4- 18.9	18.6	0.0- 1.5
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	2	11.6- 12.1	11.8	0.0- 1.5	1	8.4- 8.4	8.4	0.0- 0.0	2	4.8- 11.2	8.0	0.0- 1.5
MAX DEPTH**	2	11.6- 12.1	11.8	0.0- 1.5	1	4.0- 4.0	4.0	2.1- 2.1	2	4.8- 11.2	8.0	0.0- 1.5
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	3	85.- 115.	98.	0.0- 1.5	1	92.- 92.	92.	0.0- 0.0	3	240.- 250.	250.	0.0- 1.5
MAX DEPTH**	2	85.- 115.	100.	0.0- 1.5	1	96.- 96.	96.	2.1- 2.1	2	250.- 250.	250.	0.0- 1.5
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	3	7.6- 7.7	7.7	0.0- 1.5	1	8.9- 8.9	8.9	0.0- 0.0	3	7.4- 8.7	8.3	0.0- 1.5
MAX DEPTH**	2	7.6- 7.7	7.6	0.0- 1.5	1	6.7- 6.7	6.7	2.1- 2.1	2	7.4- 8.7	8.0	0.0- 1.5
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	3	21.- 23.	21.	0.0- 1.5	1	25.- 25.	25.	0.0- 0.0	3	43.- 45.	44.	0.0- 1.5
MAX DEPTH**	2	21.- 23.	22.	0.0- 1.5	1	28.- 28.	28.	2.1- 2.1	2	44.- 45.	45.	0.0- 1.5
TOTAL P (MG/L)												
0.-1.5 M DEPTH	3	0.034-0.051	0.050	0.0- 1.5	1	0.073-0.073	0.073	0.0- 0.0	3	0.067-0.175	0.087	0.0- 1.5
MAX DEPTH**	2	0.050-0.051	0.050	0.0- 1.5	1	0.128-0.128	0.128	2.1- 2.1	2	0.087-0.175	0.131	0.0- 1.5
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	3	0.008-0.024	0.009	0.0- 1.5	1	0.013-0.013	0.013	0.0- 0.0	3	0.009-0.012	0.010	0.0- 1.5
MAX DEPTH**	2	0.008-0.024	0.016	0.0- 1.5	1	0.018-0.018	0.018	2.1- 2.1	2	0.010-0.012	0.011	0.0- 1.5
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	3	0.060-0.150	0.120	0.0- 1.5	1	0.120-0.120	0.120	0.0- 0.0	3	0.030-0.070	0.060	0.0- 1.5
MAX DEPTH**	2	0.060-0.150	0.105	0.0- 1.5	1	0.160-0.160	0.160	2.1- 2.1	2	0.030-0.060	0.045	0.0- 1.5
AMMONIA (MG/L)												
0.-1.5 M DEPTH	3	0.050-0.080	0.060	0.0- 1.5	1	0.100-0.100	0.100	0.0- 0.0	3	0.040-0.090	0.070	0.0- 1.5
MAX DEPTH**	2	0.050-0.060	0.055	0.0- 1.5	1	0.180-0.180	0.180	2.1- 2.1	2	0.040-0.090	0.065	0.0- 1.5
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	3	0.300-0.800	0.600	0.0- 1.5	1	1.000-1.000	1.000	0.0- 0.0	3	0.600-2.300	0.700	0.0- 1.5
MAX DEPTH**	2	0.300-0.800	0.550	0.0- 1.5	1	0.800-0.800	0.800	2.1- 2.1	2	0.600-2.300	1.450	0.0- 1.5
SECCHI DISC (METERS)												
	1	0.9- 0.9	0.9		1	0.9- 0.9	0.9		2	0.7- 1.0	0.8	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera		Algal Units per ml
04/16/73	1.	Flagellates	1,187
	2.	Stephanodiscus	1,038
	3.	Ankistrodesmus	519
	4.	Melosira	408
	5.	Pennate diatoms	389
		Other genera	594
		Total	4,135
07/23/73	1.	Melosira	1,304
	2.	Fragilaria	389
	3.	Anabaena	369
	4.	Scenedesmus	276
	5.	Flagellates	253
		Other genera	902
		Total	3,493
10/02/73	1.	Flagellates	33,237
	2.	Melosira	902
	3.	Stephanodiscus	451
	4.	Scenedesmus	450
	5.	Pediastrum	193
		Other genera	580
		Total	35,813

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/liter)
04/16/73	1	15.5
	2	9.1
07/23/73	1	38.1
10/02/73	1	10.7
	2	121.4

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.035	0.100	4.2
0.05 P	0.085	0.100	3.9
0.05 P + 1.0 N	0.085	1.100	23.1
1.00 N	0.035	1.100	10.4

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential for primary productivity was high in Pinecliff Lake at the time of sampling. The lake was nitrogen limited at that time as indicated by the increased growth of the test alga in response to the addition of a nitrogen spike. Spikes with nitrogen and phosphorus simultaneously resulted in a maximum yield while the addition of phosphorus alone did not stimulate growth beyond the control yield.

The N/P ratio of 10/1 in the spring lake data further indicates nitrogen limitation.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the New Jersey National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff month of February when two samples were collected. Sampling was begun in July 1973, and was completed in June 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New Jersey District Office of USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual concentrations in Unnamed Creek at Station B(1) and mean annual ZZ flow.

The operators of the Crescent Park, Olde Milford Plant, Milford Manor Nursing Home, and Reflection Lakes wastewater treatment plants provided monthly effluent samples and corresponding flow data.

A. Waste Sources:

1. Known municipal -

Name	Population Served *	Treatment*	Mean Flow ($m^3/d \times 10^3$)	Receiving Water*
Crescent Park (West Milford)	724	Activated Sludge	0.246	Belcher Creek
Olde Milford Plant (West Milford)	480	Activated Sludge	0.199	Pinecliff Lake
Milford Manor Nursing Home (West Milford)	150	Activated Sludge	0.019	Pinecliff Lake
Reflection Lakes (Butler)	80	Activated Sludge	0.008	Pinecliff Lake

2. Known industrial - None

*Treatment plant questionnaires.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A(2) Belcher Creek	815	41.1
B(1) Unnamed Creek	35	1.8
b. Minor tributaries and immediate drainage (nonpoint load) -	35	1.8
c. Known municipal STP's -		
Crescent Park	620	31.3
Olde Milford Plant	215	10.9
Milford Manor Nursing Home	205	10.3
Reflection Lakes	25	1.3
d. Septic tanks* -	20	1.0
e. Known industrial - None		
f. Direct precipitation** -	10	0.5
Total	1,980	100.0

2. Outputs - A(1) Belcher Creek 800

3. Net annual P accumulation 1,180

*Estimate based on 78 lakeside residences.
**Estimated (see NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source		kg N/yr	% of total
a.	Tributaries (nonpoint load) -		
	A(2) Belcher Creek	8,000	58.1
	B(1) Unnamed Creek	1,135	8.3
b.	Minor tributaries and immediate drainage (nonpoint load) -	1,150	8.4
c.	Known municipal STP's -		
	Crescent Park	1,195	8.7
	Olde Milford Plant	650	4.7
	Milford Manor Nursing Home	130	0.9
	Reflection Lakes	55	0.4
d.	Septic tanks* -	830	6.0
e.	Known industrial - None		
f.	Direct precipitation** -	615	4.4
	Total	13,760	100.0

2. Outputs - A(1) Belcher Creek 9,595

3. Net annual N accumulation - 4,165

*Estimate based on 78 lakeside residences.
**Estimated (see NES Working Paper No. 175).

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
A(2) Belcher Creek	58	567
B(1) Unnamed Creek	22	709

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Yearly Phosphorus Loading (g/m²/yr)
Estimated loading for Pinecliff Lake	3.47
Vollenweider's "dangerous" or eutrophic loading	0.86
Vollenweider's "permissible" or oligotrophic loading	0.43

V. LITERATURE REVIEWED

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, and Corvallis Environmental Research Laboratory, Corvallis, Oregon.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3409 PINECLIFF LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 18.8

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3409A1	18.8	0.42	0.42	0.68	0.57	0.40	0.25	0.20	0.22	0.21	0.25	0.40	0.42	0.37
3409A2	14.1	0.31	0.31	0.51	0.40	0.27	0.18	0.14	0.15	0.14	0.17	0.31	0.31	0.27
3409B1	1.6	0.062	0.062	0.108	0.085	0.054	0.028	0.020	0.022	0.021	0.027	0.054	0.062	0.050
3409ZZ	3.2	0.062	0.062	0.102	0.079	0.054	0.034	0.027	0.028	0.028	0.034	0.062	0.062	0.053

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 18.8
SUM OF SUB-DRAINAGE AREAS = 18.8

TOTAL FLOW IN = 4.44
TOTAL FLOW OUT = 4.45

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3409A1	7	73	0.311	21	0.340				
	8	73	0.119	19	0.091				
	9	73	0.079	8	0.065				
	10	73	0.150	14	0.076				
	11	73	0.147						
	12	73	0.821	2	0.159				
	1	74	0.510	20	0.340				
	2	74	0.396	10	0.272	24	0.595		
	3	74	0.566	24	0.708				
	4	74	0.708	7	0.736				
	5	74	0.425	12	0.708				
	6	74	0.244	23	0.181				
3409A2	7	73	0.218	21	0.238				
	8	73	0.074	19	0.054				
	9	73	0.048	8	0.037				
	10	73	0.096	14	0.045				
	11	73	0.093						
	12	73	0.595	2	0.102				
	1	74	0.368	20	0.229				
	2	74	0.283	10	0.187	24	0.425		
	3	74	0.425	24	0.510				
	4	74	0.510	7	0.538				
	5	74	0.311	12	0.538				
	6	74	0.164	23	0.119				

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3409 PINECLIFF LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3409B1	7	73	0.040	21	0.042				
	8	73	0.008	19	0.005				
	9	73	0.005	8	0.003				
	10	73	0.012	14	0.004				
	11	73	0.012						
	12	73	0.125	2	0.013				
	1	74	0.076	20	0.042				
	2	74	0.057	10	0.031	24	0.091		
	3	74	0.091	3	0.054	24	0.108		
	4	74	0.105	7	0.113				
	5	74	0.062	12	0.110				
	6	74	0.025	23	0.016				
3409Z2	7	73	0.042	21	0.048				
	8	73	0.015	19	0.011				
	9	73	0.010	8	0.007				
	10	73	0.019	14	0.009				
	11	73	0.019						
	12	73	0.119	2	0.020				
	1	74	0.074	20	0.045				
	2	74	0.057	10	0.037	24	0.085		
	3	74	0.085	24	0.102				
	4	74	0.102	7	0.108				
	5	74	0.062	12	0.108				
	6	74	0.031	23	0.024				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/06/04

340901
41 08 14.0 074 22 12.0 3
PINECLIFF LAKE
34031 NEW JERSEY

013292

11EPALES 2111202
0009 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/16	16	15 0000	13.1			98	7.70	21	0.080	0.600	0.120	0.009
	16	15 0005	13.2	11.6		85	7.70	21	0.050	0.300	0.060	0.008
73/07/23	18	15 0000	25.7	8.4	36	92	8.90	25	0.100	1.000	0.120	0.013
	18	15 0007	24.4	4.0		96	6.70	28	0.180	0.800	0.160	0.018
73/10/02	15	00 0000	18.9		38	240	8.30	43	0.070	0.700	0.070	0.009
	15	00 0005	18.4	4.8		250	7.40	45	0.090	0.600	0.060	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/16	16	15 0000	0.034	15.5
	16	15 0005	0.050	
73/07/23	18	15 0000	0.073	38.1
	18	15 0007	0.128	
73/10/02	15	00 0000	0.067	10.7
	15	00 0005	0.087	

STORET RETRIEVAL DATE 76/06/04

340902
41 07 38.0 074 22 48.0 3
PINECLIFF LAKE
34031 NEW JERSEY

013292

11EPALES 2111202
0003 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/16	16 30	0000	13.0	12.1	36	115	7.60	23	0.060	0.800	0.150	0.024
73/10/02	15 15	0000	18.9	11.2	28	250	8.70	44	0.040	2.300	0.030	0.012

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/16	16 30	0000	0.051	9.1
73/10/02	15 15	0000	0.175	121.4

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/06/04

3409A1
41 08 15.0 074 22 02.0 4
BELCHER CREEK
34 7.5 GREENWOOD LK
O/PINECLIFF LAKE 013292
UNION VALLEY RD BRDG IN WEST MILFORD
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	12 15		0.075	1.260	0.200	0.019	0.095
73/08/19	12 15		0.048	1.050	0.086	0.018	0.090
73/09/08	12 25		0.084	1.800	0.147	0.006	0.095
73/12/02	11 00		0.014	0.600	0.024	0.008	0.080
74/01/20	13 15		0.252	0.200	0.032	0.016	0.050
74/02/10	10 45		0.192	0.500	0.015	0.020	0.065
74/02/24	11 30		0.220	0.400	0.020	0.015	0.060
74/03/24	11 30		0.032	0.600	0.020	0.015	0.065
74/04/07	12 45		0.012	0.400	0.015	0.010	0.040
74/05/12	14 00		0.020	0.400	0.020	0.010	0.055
74/06/23	12 00		0.024	1.000	0.045	0.010	0.070

STORET RETRIEVAL DATE 76/06/04

3409A2
41 07 28.0 074 22 47.0 4
BELCHER CREEK
34 7.5 NEWFOUNDLAND
I/PINECLIFF LAKE 013391
2NDRY RD BRDG BTWN LAKE & MINES POND
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	12 00		0.230	0.750	0.126	0.040	0.105
73/08/19	12 30		0.080	1.000	0.095	0.021	0.092
73/09/08	12 15		0.014	1.760	0.044	0.010	0.125
73/10/14	13 30		0.180	1.650	0.250	0.061	0.105
73/12/02	11 15		0.672	0.300	0.048	0.092	0.150
74/01/20	13 30		0.610	0.100K	0.048	0.064	0.085
74/02/10	11 05		0.672	0.300	0.050	0.085	0.120
74/02/24	11 05		0.570	0.400	0.045	0.050	0.090
74/03/24	10 30		0.340	0.200	0.025	0.035	0.065
74/04/07	11 35		0.270	0.200	0.020	0.032	0.040
74/05/12	11 00		0.252	0.400	0.055	0.025	0.115
74/06/23	13 30		0.380	0.500	0.070	0.055	0.110

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

3409B1
41 08 06.0 074 22 35.0 4
UNNAMED CREEK
34 7.5 WAWAYANDA
T/PINECLIFF LAKE 013292
2NDRY RD BRDG ON E SIDE OF LAKE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	12 20		0.140	0.560	0.115	0.005K	0.010
73/08/19	12 00		0.189	3.300	0.105	0.007	0.010
73/10/14	13 00		0.082	2.300	0.336	0.042	0.130
73/12/02	11 45		0.032	0.100	0.068	0.016	0.035
74/01/20	13 00		0.110	0.100K	0.020	0.005K	0.005K
74/02/10	10 30		0.050	0.500	0.025	0.005K	0.005K
74/02/24	11 15		0.120	0.100K	0.015	0.005K	0.010
74/03/03	14 30		0.052	0.100K	0.030	0.010	0.020
74/03/24	11 15		0.040	0.300	0.030	0.005K	0.005
74/04/07	12 00		0.020	0.200	0.020	0.005	0.005
74/05/12	12 00		0.070	0.100	0.025	0.005	0.010
74/06/23	11 00		0.068	0.100K	0.010	0.005K	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

3409AA AS3409AA P000724
41 08 36.0 074 21 19.0 4
CRESCENT PARK (WEST MILFORD)
34 7.5 GREENWOOD LA
T/PINECLIFF LAKE 013292
BELLHER CREEK
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/11/30	08 00		4.500	3.000	0.110	5.800	6.500	0.065	0.063
73/12/31	08 45		9.600	7.000	0.130	6.500	7.250	0.065	0.066
74/01/23	09 30		6.300	8.500	1.040	6.200	6.300	0.068	0.066
74/02/08	16 00		10.900	3.800	0.051	6.500	7.400	0.063	0.066
74/02/28	10 40		8.000	10.000	4.800	6.200	7.000	0.066	0.067
74/03/29	09 50		0.800	9.000	2.100	5.600	6.800	0.062	0.066
74/04/23	09 30		11.000	4.800	0.580	8.200	8.800	0.050	0.065
74/05/16	08 30		4.600	4.700	2.500	7.000	7.700	0.066	0.067
74/06/17	08 15		12.300	1.100	0.073	4.900	5.300	0.080	0.066
74/07/10	08 40		15.200	1.000K	0.050K	6.200	6.300	0.061	0.064
74/07/30	09 45		6.800	3.800	0.380	7.200	7.500	0.055	0.058

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

340921 AS340921 P000480
41 08 25.0 074 22 06.0 4
OLDE MILFORD PLANT (W.MILFORD)
34 7.5 GREENWOOD LA
O/PINECLIFF LAKE 013292
PINECLIFF LAKE
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/07/30	08 37		2.200	6.700	0.490	4.900	5.600	0.035	0.032
73/08/29	12 15			0.480	0.056	4.800	4.900	0.028	0.034
73/09/27	08 30		15.600	2.300	0.570	7.900	8.100	0.024	0.025
73/10/26	08 40		28.000	0.100K	0.050	7.640		0.022	0.024
73/11/23	08 20		13.600	0.100K	0.025	7.000	7.000	0.022	0.025
73/12/27	08 30		0.880	5.600	1.500	0.800	1.400	0.100	0.080
74/01/24	08 30		1.400	1.700	0.590	0.480	0.670	0.120	0.080
74/02/20	08 30		1.280	7.500	2.400	0.990	2.200	0.090	0.073
74/03/27	08 30		0.440	3.000	1.700	1.100	1.650	0.060	0.070
74/04/26			0.240	7.300	3.700	1.750	2.900	0.049	0.080
74/05/30	08 30		0.160	25.000	9.000	4.200	5.900	0.029	0.060
74/06/20	08 40		18.000	1.000K	0.170	4.505	4.825	0.032	0.036
74/07/25	08 30		5.280	1.000K	0.120	5.300	5.600	0.033	0.036

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

340931 AS340931 P000150
41 08 25.0 074 22 06.0 4
MILFORD MANOR NURSING HOME(W MIL
34 7.5 GREENWOOD LA
O/PINECLIFF LAKE 013292
PINECLIFF LAKE
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/07/30	10 35		16.200	1.600	0.130	21.000	23.000	0.015	0.015
73/08/29	10 45			0.360	0.079	28.000	31.000	0.005	0.005
73/09/27	11 00		21.700	1.400	0.043	36.000	36.000	0.004	0.004
73/10/26	10 45		18.600	1.200	0.038	33.000	38.000	0.005	0.005
73/11/23	10 30		18.000	0.100K	0.010K	26.000	27.000	0.003	0.004
73/12/26	10 30		17.000	0.500K	0.077	27.000	27.000	0.004	0.004
74/01/24	10 30		18.000	0.500K	0.040K	26.000	26.300	0.004	0.005
74/02/25	09 30		19.000	2.500	0.050K	28.500	28.500	0.004	0.004
74/03/27	11 15		18.000	1.000K	0.170	33.800	40.000	0.004	0.004
74/04/26	10 45		23.000	1.600	0.072	31.000	35.000	0.004	0.004
74/05/30	10 30		17.000	1.500	0.050K	38.000	39.000	0.004	0.004
74/06/20	10 20		12.600	1.200	0.050K	24.300	26.800	0.004	0.004
74/07/25	10 40		8.100	1.000K	0.067	17.520	17.800	0.004	0.004

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

340941 AS340941 P000080
41 08 25.0 074 22 06.0 4
REFLECTION LAKES (BUTLER)
34 7.5 GREENWOOD LA
0/PINECLIFF LAKE 013292
PINECLIFF LAKE
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/07/29	12 00		10.500	7.700	0.140		8.900	0.002	0.002
73/09/01	09 00				0.075	8.500	8.700	0.002	0.002
73/10/06	10 00		23.500	0.250	0.083	9.000	9.000	0.002	0.002
73/11/03	09 00		22.000	1.000K	0.010K	6.200	6.200	0.002	0.002
74/01/26	12 00		16.800	1.000K	0.040K	8.100	8.300	0.002	0.002
74/03/02	13 00		17.000	4.400	1.980	6.950	7.200	0.002	0.002
74/04/13	09 00		19.200	3.200	0.765	7.150	8.000	0.002	0.002
74/05/05	10 00		2.520	3.000	0.430	9.300	10.000	0.002	0.002
74/08/06	11 00		28.000	1.000K	0.050K	5.750	6.000	0.002	0.002

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1973

STATE OF NEW JERSEY

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3402	BUDD LAKE	0.082	0.205	474.000	48.500	7.400	0.012
3403	GREENWOOD LAKE	0.021	0.100	414.250	11.920	14.800	0.007
3406	ORADELL RESERVOIR	0.055	0.990	462.500	22.267	13.600	0.008
3409	PINECLIFF LAKE	0.070	0.175	465.500	38.960	11.000	0.011
3410	POMPTON LAKES	0.071	0.795	463.167	23.033	11.800	0.029
3412	DUHERNAL LAKE	0.082	1.420	466.667	6.800	8.600	0.010
3413	FARRINGTON LAKE	0.055	0.770	462.000	8.283	14.400	0.012
3415	LAKE HOPATCONG	0.022	0.120	416.333	13.627	14.900	0.007
3417	LAKE MUSCONETCONG	0.036	0.140	436.000	11.067	6.000	0.010
3419	PAULINS KILL LAKE	0.133	0.950	460.500	7.017	9.000	0.065
3420	SPRUCE RUN RESERVOIR	0.020	0.470	428.667	15.333	15.000	0.007
3422	UNION LAKE	0.063	1.150	463.200	22.080	12.800	0.018
3423	WANAQUE RESERVOIR	0.014	0.120	355.333	7.111	14.800	0.005

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3402	BUDD LAKE	12 (1)	58 (7)	0 (0)	0 (0)	92 (11)	29 (3)	191
3403	GREENWOOD LAKE	83 (10)	100 (12)	92 (11)	58 (7)	21 (2)	83 (9)	437
3406	ORADELL RESERVOIR	54 (6)	17 (2)	42 (5)	25 (3)	42 (5)	67 (8)	247
3409	PINECLIFF LAKE	33 (4)	67 (8)	17 (2)	8 (1)	67 (8)	42 (5)	234
3410	POMPTON LAKES	25 (3)	33 (4)	33 (4)	17 (2)	58 (7)	8 (1)	174
3412	DUHERNAL LAKE	12 (1)	0 (0)	8 (1)	100 (12)	83 (10)	58 (7)	261
3413	FARRINGTON LAKE	54 (6)	42 (5)	50 (6)	75 (9)	33 (4)	29 (3)	283
3415	LAKE HOPATCONG	75 (9)	87 (10)	83 (10)	50 (6)	8 (1)	83 (9)	386
3417	LAKE MUSCONETCONG	67 (8)	75 (9)	67 (8)	67 (8)	100 (12)	50 (6)	426
3419	PAULINS KILL LAKE	0 (0)	25 (3)	58 (7)	92 (11)	75 (9)	0 (0)	250
3420	SPRUCE RUN RESERVOIR	92 (11)	50 (6)	75 (9)	42 (5)	0 (0)	83 (9)	342
3422	UNION LAKE	42 (5)	8 (1)	25 (3)	33 (4)	50 (6)	17 (2)	175
3423	WANAQUE RESERVOIR	100 (12)	87 (10)	100 (12)	83 (10)	21 (2)	100 (12)	491

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3423	WANAQUE RESERVOIR	491
2	3403	GREENWOOD LAKE	437
3	3417	LAKE MUSCONETCONG	426
4	3415	LAKE HOPATCONG	386
5	3420	SPRUCE RUN RESERVOIR	342
6	3413	FARRINGTON LAKE	283
7	3412	DUHERNAL LAKE	261
8	3419	PAULINS KILL LAKE	250
9	3406	ORADELL RESERVOIR	247
10	3409	PINECLIFF LAKE	234
11	3402	BUDD LAKE	191
12	3422	UNION LAKE	175
13	3410	POMPTON LAKES	174